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Data Paper

Comparative study of qualitative and quantitative characters of grape cultivar 'Mavrodafni' (*Vitis vinifera* L.) and 'Renio' grown in different regions of the Protected Designation of Origin Mavrodafni Patras

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Abstract

Background

'Mavrodafni' (*Vitis vinifera* L.) is considered one of the oldest grapevine cultivars indigenous to the Greek vineyards, with western Peloponnese being its primary centre of cultivation. 'Renio' is considered to be either a biotype of 'Mavrodafni' or an altogether different cultivar. Both 'Mavrodafni' and 'Renio' can be found in the vineyards of the areas of cultivation, since 'Renio' is considered to be more productive compared to 'Mavrodafni' and, for this reason, it has gradually replaced 'Mavrodafni' from cultivation over the course of time.

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New information

'Mavrodafni' and 'Renio' contain appreciable amounts of quality characters of grape and must in terms of total polyphenol and total anthocyanins content in berry skins, depending on the different regions where they are cultivated and they would be worthy of further study and use for the production of different types of wines.

Keywords

anthocyanins, grape skins, must, polyphenols, tannins, *Vitis vinifera* L.

Introduction

The Pelopponnese peninsula is one of the oldest grapevine producing regions of Greece, hosting a great variety of cultivars across its vineyeards, some of which are of primary importance for the Greek vine producing industry as whole.

During the past years, the problems related to the knowledge of varietal potential, as well as to sanitation of grapevine propagating material, have increased to such an extent that they threaten the viticultural production, as well as the establishment of productive vineyards.

In addition, in the wider viticultural Protected Designation of Origin (PDO) region Mavrodafni Patras, factors such as the application of cultivation techniques related to vineyard management resulting in increased yield (per ha), raise questions regarding the quality of wine products, as well as regarding the overall future of viticulture in the region.

In view of climate change and the depletion of natural resources due to the intensification of vine growing, it is imperative that inputs be reduced.

'Mavrodafni' is a significant red grapevine cultivar with the Peloponnese and the Ionian islands being its cultivation centres. It has been described as 'Mavrodaphne' (Guillon 1896, Viala and Vermorel 1909) and as 'Mavrodaphni noir' (Rovasenda 1887). It is a very vigorous grapevine cultivar of medium yield capacity. However, it is characterised by intense poor fruit set and this demands the use of specific cultivation techniques that increase cultivation cost (Stavrakakis 2010).

'Renio' is considered either a biotype of Mavrodafni or an altogether different cultivar. A study that employed molecular markers showed that they are different cultivars (Stavrakaki and Biniari 2009). 'Renio' is less vigorous, less qualitative, but more productive compared to 'Mavrodafni' and does not require specific cultivation techniques. For this reason, it has gradually replaced 'Mavrodafni' from cultivation over the course of time or, in some cases, it is co-cultivated with 'Mavrodafni', with adverse effects on the quality of the wine.

General description

Purpose: The aim of the present study was to assay the mechanical properties, the polyphenolic content and the antioxidant capacity of skin extracts and must of berries of 'Mavrodafni' and 'Renio', cultivated in the same vineyard, as well as in the different regions of cultivation of the PDO Mavrodafni Patras (See Suppl. material 1).

Additional information: 'Mavrodafni' recorded the highest content in skin total phenolics, skin total anthocyanins and skin total tannins in all studied regions, with a significant difference compared to 'Renio' (Tables 2, 3, 4).

Table 1.

Cultivars studied and vineyards' characteristics.

a/a	Cultivar	Vineyard	Training system	Age	Altitude
1	Mavrodafni	Arla	Cordon	20 years	600 m
2	Renio Arla	Arla	Cordon	20 years	600 m
3	Mavrodafni	Fostaina	Cordon	6 years	400 m
4	Mavrodafni	Karantzas	Cordon	30 years	200 m
5	Renio	Karantzas	n/a	30 years	200 m
6	Mavrodafni	Karyes	Cordon	5 years	n/a
7	Renio	Karyes	Cordon	5 years	n/a
8	Mavrodafni	Katw Mylos	n/a	n/a	n/a
9	Renio	Katw Mylos	n/a	n/a	n/a
10	Mavrodafni	Linos	n/a	30 years	0 m

Table 2.

Characters of the must.

	pH	Sugars	Total Titr. Acidity
Mavrodafni_Arla	3.17 ± 0.00g	17.16 ± 0.03f	6.75 ± 0.00ab
Renio_Arla	3.15 ±0.00g	12.06 ± 0.06h	5.50 ± 0.25de
Mavrodafni_Fostaina	3.71 ± 0.00b	18.90 ± 0.00c	5.25 ± 0.00e
Mavrodafni_Karantzas	3.39 ± 0.00f	17.43 ± 0.03d	6.25 ± 0.12bc
Renio_Karantzas	3.56 ± 0.00d	18.50 ± 0.00e	6.00 ± 0.00cd
Mavrodafni_Karyes	3.44 ± 0.00e	12.26 ± 0.03g	6.62 ± 0.12ab
Renio_Karyes	3.39 ± 0.00h	12.36 ± 0.03g	7.00 ± 0.25a
Mavrodafni_KatwMylos	3.56 ± 0.00d	21.76 ± 0.00a	5.25 ± 0.00e

	pH	Sugars	Total Titr. Acidity
Renio_KatwMylos	3.74 ± 0.00a	21.76 ± 0.03b	4.50 ± 0.00f
Mavrodafni_Linos	3.65 ± 0.00c	21.80 ± 0.00b	5.25 ± 0.00e

Table 3.

Mechanical properties of the bunch.

	Bunch length	Bunch width	Bunch weight
Mavrodafni_Arla	19.66 ± 1.85ab	9.66 ± 0.66abc	248.33 ± 54.63abc
Renio_Arla	18.66 ± 0.88abc	8.26 ± 0.37bc	251.66 ± 32.05abc
Mavrodafni_Fostaina	17.00 ± 1.73abcd	9.00 ± 0.57bc	300.00 ± 10.69ab
Mavrodafni_Karantzas	13.90 ± 0.10cd	9.50 ± 0.76abc	165.33 ± 6.33cd
Renio_Karantzas	15.33 ± 1.76abcd	6.00 ± 0.57c	208.00 ± 13.52bcd
Mavrodafni_Karyes	18.00 ± 0.57abcd	13.33 ± 1.66a	259.66 ± 38.80abc
Renio_Karyes	20.33 ± 0.66a	10.83 ± 0.16ab	291.33 ± 25.72abc
Mavrodafni_KatwMylos	13.66 ± 0.66cd	9.16 ± 0.92abc	223.00 ± 8.73abcd
Renio_KatwMylos	13.00 ± 0.00d	8.33 ± 0.60bc	168.00 ± 24.09bcd
Mavrodafni_Linos	14.83 ± 1.09bcd	5.50 ± 0.28c	90.66 ± 3.52d

Table 4.

Total polyphenol content and antioxidant capacity in berry skins.

	Skin total phenolics (mg catechin/g f.w.)	Skin total anthocyanins (mg malvidin/ g f.w.)	Skin total flavanols (mg catechin/g f.w.)	Skin total tannins (mg catechin/ g f.w.)	Skin total flavonoids (mg catechin/g f.w)	Skin total flavones (mg rutin/ g f.w.)	Antioxidant capacity (mg trolox/g f.w.)
Mavrodafni_Arla	52.20 ± 3.44d	12.60 ± 0.48b	3.79 ± 0.06b	61.63 ± 2.50b	8.96 ± 0.70d	1.89 ± 0.08abc	63.25 ± 0.98cd
Renio_Arla	54.40 ± 0.57d	5.76 ± 0.20f	4.06 ± 0.04a	63.45 ± 1.18ab	9.10 ± 0.61cd	1.35 ± 0.10cd	65.07 ± 0.49c
Mavrodafni_Fostaina	61.52 ± 3.16cd	11.20 ± 0.31bcd	3.36 ± 0.03cd	68.07 ± 1.34ab	5.95 ± 0.35e	1.60 ± 0.10bcd	64.89 ± 0.73c
Mavrodafni_Karantzas	60.40 ± 1.52cd	13.00 ± 0.24b	3.14 ± 0.02e	68.87 ± 0.85a	5.70 ± 0.23e	1.72 ± 0.18abcd	57.80 ± 0.82d

	Skin total phenolics (mg catechin/g f.w.)	Skin total anthocyanins (mg malvidin/ g f.w.)	Skin total flavanols (mg catechin/g f.w.)	Skin total tannins (mg catechin/ g f.w.)	Skin total flavonoids (mg catechin/g f.w)	Skin total flavones (mg rutin/ g f.w.)	Antioxidant capacity (mg trolox/g f.w.)
Renio_Karantzas	91.36 ± 1.45a	8.20 ± 0.42ef	3.79 ± 0.01b	31.89 ± 1.45cd	11.50 ± 0.22ab	2.13 ± 0.06ab	64.49 ± 0.34c
Mavrodafni_Karyes	64.40 ± 1.31c	11.88 ± 0.60bc	3.19 ± 0.05de	70.54 ± 1.24a	5.63 ± 0.33e	1.31 ± 0.04cd	76.88 ± 0.52b
Renio_Karyes	73.92 ± 0.24b	9.60 ± 0.34cde	3.88 ± 0.03b	21.56 ± 0.99e	10.36 ± 0.26abcd	1.15 ± 0.05d	76.63 ± 1.95b
Mavrodafni_KatwMylos	81.02 ± 0.91b	16.92 ± 0.30a	3.34 ± 0.02c	19.38 ± 0.85e	9.96 ± 0.03bcd	1.90 ± 0.11abc	80.49 ± 0.45b
Renio_KatwMylos	97.44 ± 1.32a	8.88 ± 0.27de	3.34 ± 0.01cd	38.90 ± 0.89c	12.08 ± 0.14a	2.31 ± 0.20a	65.44 ± 0.63c
Mavrodafni_Linos	80.16 ± 0.96b	18.16 ± 0.52a	3.28 ± 0.03cde	22.58 ± 2.60e	11.65 ± 0.44ab	2.11 ± 0.04ab	89.01 ± 0.43a

Sampling methods

Study extent: The vineyards, from where the samples were collected, are located in the greater area of Achaia (Table 1). The vines were selected for study via an assay of their polyphenolic profile on the basis of:

- their being the most representative for each cultivar and
- their morphology.

Sampling description: Grapes were randomly selected from different vines of each cultivar and three (3) sampling processes took place. The grapes were collected from the main shoots of different positions. Each sampling constituted one replication. A total of three (3) replications per treatment (cultivar) took place. The sampling process and samples preparation for spectrophotometric and HPLC analyses, as well as the data analysis described in Stavrakaki et al. (2018), were followed for the needs of this experiment. The various polyphenolic compounds analysed were identified according to their order of elution and the retention times of the pure compounds. The reagents and chemicals used were the same as in Biniari et al. (2018).

Step description: Measurements:

- Bunch and berry mechanical properties (weight, length and width)
- Measurement of total soluble solids, pH and total titratable acidity
- Measurement of total polyphenol content in berry skins

- Measurement of total anthocyanins in berry skins
- Measurement of total flavonoid content
- Measurement of total flavanols
- Measurement of flavone and flavonol content
- Measurement of total tannins in berry skins
- Measurement of antioxidant capacity in berry skins

Geographic coverage

Description: The vineyards, from where the samples were collected, are located in the greater area of Achaia.

Coordinates: and 38.0568 Latitude; and 21.5984 Longitude.

Temporal coverage

Data range: 2017-1-01 - 2018-9-30.

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Data resources

Data package title: Quality characteristics measurements

Number of data sets: 1

Data set name: Mavrodafni and Renio quality characteristics measurements

Column label	Column description
Samples	Samples collected from the cultivars studied and related regions
pH	Measurement: pH
Sugars (Brix)	Total soluble solids measured in Brix
Total titratable acidity	Total titratable acidity measured in g tartaric acid/l must
Bunch length (cm)	Bunch length measured in cm
Bunch width (cm)	Bunch width measured in cm
Bunch weight (g)	Bunch weight measured in g
Skin total phenolics (mg catechin/g f.w.)	Total phenolics of berry skin measured in mg catechin/g fresh weight

Skin total anthocyanins (mg malvidin/g f.w.)	Total anthocyanins of berry skin measured in mg malvidin/g fresh weight
Skin total flavanols (mg catechin/g f.w.)	Total flavanols of berry skin measured in mg catechin/g fresh weight
Skin total tannins (mg catechin/g f.w.)	Total tannins of berry skin measured in mg catechin/g fresh weight
Skin total flavonoids (mg catechin/g f.w)	Total flavonoids of berry skin measured in mg catechin/g fresh weight
Skin total flavones (mg rutin/g f.w.)	Total flavones of berry skin measured in mg rutin/g fresh weight
Antioxidant capacity (mg trolox/mg f.w.)	Antioxidant capacity of berry skin measured in mg trolox/g fresh weight

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Supplementary material

Suppl. material 1: Mavrodafni and Renio quality characteristics measurements doi

Authors: Katerina Biniari, Ioannis Daskalakis, Despoina Bouza, Maritina Stavrakaki
Data type: Excel file of the samples collected and the measurements performed
Brief description: This is the raw dataset of the measurements performed on the samples collected from the two varieties from the different locations. There are three repetitions per measurement and no statistical analysis has been performed.
Download file (12.73 kb)